DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMITTING and COMPLIANCE DIVISION
MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM (MPDES)

Fact Sheet/Statement of Basis

Permittee:	Town of Sheridan
Permit No.:	MT0022098
Receiving Water:	Outfall 001 – Unnamed ditch to South Indian Creek Outfall 002 – Unnamed tributary to Leonard Slough
Facility Information:	
Name	Sheridan Municipal Wastewater Treatment Facility
Location	T 4S, R 5W, Section 27, Madison County
Facility Contact:	Dean Dairyberry, Mayor P.O. Box 78 Sheridan, MT 59749 (406) 842-5431
Fee Information:	
Number of Outfalls	1 (for fee purposes)
Outfall – Type	001 – treated domestic wastewater 002 – treated domestic wastewater

I. Permit Status

This is a renewal Montana Pollutant Discharge Elimination System (MPDES) permit for the Town of Sheridan wastewater treatment facility. The previous permit was issued on January 1, 1996 and expired on January 31, 2001. The permittee submitted an MPDES permit application and application fees to the Department of Environmental Quality (Department) in April 2000. Pursuant to ARM 17.30.1313 the expired permit remains effective until the renewed permit is issued.

The permit was modified in April 1996 to correctly identify the receiving water (CDM, 2006).

The permittee submitted an updated application in October 2006 to reflect a proposed new facility slated for construction in May 2008. The new facility will replace the current facility and will be built at a different location. The outfall from the new facility is Outfall 002. Outfall 002 is proposed to discharge to a different receiving water than Outfall 001.

II. Facility Information

A. Facility Description

The permittee presently operates a 6.4 acre single cell facultative lagoon for the treatment of domestic sewage (Figure 1). Discharge from the facility is continuous and is not disinfected. The facility was built in 1959 and has not undergone any significant upgrades. The original design report for the facility states the design flow is 0.060 million gallons per day (mgd; CDM, 2006). The renewal application for the existing facility states the average design discharge is 0.144 mgd. The design report discharge (0.060 mgd) is used in Table 1 and for permit limit development.

A Preliminary Engineering Report (PER) prepared for the permittee by CDM Engineering (2006) documents that the current wastewater facility is hydraulically overloaded due to inflow and infiltration (I/I). The PER states that wastewater design flow, without any reduction of I/I would be 156 gallons per capita per day (gpcd) in the winter, 406 gpcd during the summer, and average 282 gpcd.

The single cell is approximately eight feet deep with an operating depth of 5.6 feet and 2.4 feet of freeboard (CDM, 2006). Sludge depths measured in 1999 averaged 1.4 feet deep. According to the PER, sludge levels were measured again in 2006 and measurements indicated that “sludge volume had increased only slightly” (CDM, 2006). The 6.4 acre lagoon offers about 42 days detention time at an average daily flow of 205,000 gallons per day (gpd) and 4.2 feet of usable water depth (operating depth minus sludge).

The proposed new facility is a three cell aerated lagoon system that will discharge to a different receiving water than the existing lagoon. The new facility will be constructed approximately two miles northwest of the existing facility and discharge to an unnamed tributary to the Leonard Slough. Kirk Engineering, a firm hired by the permittee, reported measured flow in the unnamed tributary as 3.14 cubic feet per second (cfs) in December 2006 and 3.14 cfs in February 2007

(Kirk Engineering email correspondence, February 28, 2007). The permittee indicated in the application that treated wastewater will be land applied during the growing season (May through October).

Table 1: Outfall 001 Current Design Criteria Summary	
Facility Description: **Single cell facultative lagoon**	
Construction Date: 1959	Modification Date: NA
Design Population: 600	Current Population: 659 (2000 census)
Design Flow, Average (mgd): 0.060	Design Flow, Maximum Day (mgd): unknown
Primary Cells: 1	Secondary Cells: NA
Number Areated Cells: NA	Minimum Detention Time-System (days): 125
Design BOD Removal (%): unknown	Design BOD Load (lb/day): unknown
Design SS Removal (%): unknown	Design SS Load (lb/day): unknown
Collection System Combined [ ] Separate [x]	Estimated I/I: 0.245 mgd
SSO Events (Y/N): unknown	Bypass Events (Y/N): unknown
Disinfection (Y/N): none	Type: NA
Discharge Method: Continuous	
Sludge Storage: NA	
Sludge Disposal: NA	Permit Number: NA

The PER states that I/I reduction will be attempted through replacement of approximately 7,000 feet of collection system piping. While the engineer anticipates 50% I/I reduction, the new facility will be sized to handle the current influent flow rate (annual average is 205,000 gpd). Design criteria for the new facility are given in Table 2.

Table 2: Outfall 002 Design Criteria Summary (CDM, 2006)	
Facility Description: **Three cell aerated lagoons, UV disinfection, continuous discharge with seasonal land application**	
Construction Date: 2008	Modification Date: NA
Design Population: 726	Current Population: 659 (2000 census)
Design Flow, Average (mgd): 0.410	Design Flow, Maximum Day (mgd): unknown
Primary Cells: 2	Secondary Cells: 1
Number Areated Cells: 3	Minimum Detention Time-System (days): 41
Design BOD Removal (%): 85%	Design BOD Load (lb/day): 145
Design SS Removal (%): 65%	Design SS Load (lb/day): 160
Collection System Combined [ ] Separate [x]	Estimated I/I: 0.245 mgd
SSO Events (Y/N): unknown	Bypass Events (Y/N): unknown
Disinfection (Y/N): none	Type: NA
Discharge Method: Continuous	
Sludge Storage: NA	
Sludge Disposal: NA	Permit Number: NA

B. Effluent Characteristics

The expired permit required that the permittee monitor and report the 30-day average effluent quality for BOD_5 and TSS. The data reported for the Period of Record (POR) January 2001 through May 2006 are summarized in Table 3.

Table 3: Effluent Characteristics (Period of Record: January 2001 – May 2006)						
Parameter	Units	Previous Permit Limits (7-day/30-day)	Minimum	Maximum	Average	Number of Samples
Flow, Daily Average	mgd	(1)	0.081	0.238	0.144	63
BOD_5	mg/L	45/30	3	79.5	22	63
	lb/day	(1)	22.9	138	19.2	63
TSS	mg/L	135/100	1	126	24.9	63
	lb/day	(1)	0.9	219	30.4	63
Fecal Coliform	No./100ml	(1)	---	---	---	(2)
Total Ammonia as N	mg/L	(1)	---	---	---	(2)
Total Kjeldahl Nitrogen	mg/L	(1)	---	---	---	(2)
Nitrate + Nitrite as N	mg/L	(1)	---	---	---	(2)
Total Nitrogen	mg/L	(1)	---	---	---	(2)
	lb/day	(1)	---	---	---	(2)
Total Phosphorus	mg/L	(1)	---	---	---	(2)
	lb/day	(1)	---	---	---	(2)

(1). The pervious permit did not contain a limit for the given parameter.
(2) The permittee was not required to monitor or report for the given parameter.

C. Compliance History

The Department completed MPDES compliance inspections in April 2004 and November 2006. The permittee was cited for permit violations as a result of findings from the April 2004 inspection. Specifically, the Department-issued violation letter noted three violations: 1) BOD_5 effluent exceedance (51.2 mg/L); 2) objectionable emulsion/solid in the receiving channel and an odor of raw sewage and discoloration were noted in the receiving water; and 3) lacking facility proper operation and maintenance (O&M). Three items that demonstrated lacking O&M were: 1) failure to monitor or address the physical condition of the north lagoon dike that was actively seeping; 2) failure to act on engineering evaluation recommendations for hydrological overload reductions from increased inflow/infiltration (I/I) and population; and 3) failure to maintain the outfall weir in an operable condition. The permittee responded to the violation letter by submitting a facility upgrade schedule and a dike monitoring plan.

Significant findings from the Department's November 2006 inspection were: cattle use around the lagoon and lacking fencing around the facility; areas of cattails, trees, and bushes growing along inside lagoon dikes; and lacking correspondence on-file documenting the permittee's actions and decisions. The permittee responded by removing the cattails, trees, and bushes along the dike and replacing the fence to keep cattle out of the lagoon facility.

In December 2005, the Department issued a violation letter for BOD_5 effluent limit exceedances in March 2005 (51 mg/L) and June 2005 (79.5 mg/L). Two other Department issued violation letters are on-file that document the permittee's failures to submit monthly discharge monitoring reports (DMRs). An August 2002 letter documents the late submittal for the May 2002 monitoring period. A February 2004 letter states that the permittee failed to submit DMRs for April through December 2003.

III. Technology-Based Effluent Limits

The Montana Board of Environmental Review has adopted by reference 40 CFR 133 which defines minimum treatment requirements for secondary treatment, or the equivalent, for publicly owned treatment works (POTW) (ARM 17.30.1209). Secondary treatment is defined in terms of effluent quality as measured by Biochemical Oxygen Demand (BOD_5), Total Suspended Solids (TSS), percent removal of BOD_5 and TSS, and pH.

These requirements may be modified on a case-by-case basis for facilities that are eligible for treatment equivalent to secondary (TES) treatment (40 CFR 133.101(g)) or alternative state requirements (ASR) for TSS. To determine if a facility is eligible for TES the facility must meet the requirements of 40 CFR 133.101(g), summarized as follows:

1) The BOD_5 and TSS consistently achievable through proper operation and maintenance of the treatment works exceed the minimum effluent quality described for secondary treatment (40 CFR 122.102).
2) The treatment works utilize a trickling filter or waste stabilization pond, and
3) The treatment works utilizes biological treatment that consistently achieves a 30-day average of at least 65 percent removal (40 CFR 133.101(k)).

Water quality must not be adversely affected by the application of equivalent to secondary treatment. Effluent limits for BOD_5 cannot be relaxed unless the permittee has demonstrated that the relaxed limits will not result in a violation of water quality standards in the receiving water.

In addition to TES, permitting agencies may give special consideration to treatment works that employ waste stabilization ponds as the primary method for treating wastes. Alternative state requirements (ASR) may be incorporated into permits for lagoons if historic data for the system indicates that effluent limits based on TES cannot be achieved. The 30-day ASR for TSS in Montana is 100 mg/L [49 FR 37005; September 20, 1984]; the Department employed a 135mg/L TSS for a 7-day limit based on best profession al judgment. ASR limits may be incorporated as seasonal limits. New facilities are not eligible for ASR.

The proposed technology based limits satisfying the requirements of ARM 17.30.1209 are summarized in Table 4 for Outfall 001 and Table 5 for Outfall 002. For both Outfall 001 and 002, BOD_5 limits are based on national secondary requirements.

TSS limits for Outfall 001 are based on TES. The 95th percentile of the TSS effluent quality over the POR is 57.3 mg/L. A facility that is operating beyond its design hydraulic and organic loading and is receiving excessive I/I is not eligible for less strict effluent limits according to 40 CFR 133. The facility is not equipped with a multi-level draw-off effluent structure. The proposed TSS limits are more stringent than those in the previous permit. The previous permit allowed ASR for TSS.

TSS limits for Outfall 002 are based on national secondary requirements.

ARM 17.30.1345 [40 CFR 122.45(f)(1)] requires that effluent limits must be expressed in terms of mass (mass/time), except for certain conditions, such as pH or temperature. For municipal treatment plants, mass based limits are based on design flow (discussed in Part II) for the facility.

Mass based limits are calculated as follows:

Load (lbs/day) = Design Flow (mgd) x Concentration (mg/L) x Conversion Factor (8.34)

Outfall 001
BOD:

30-d	Load = 0.060 mgd x 30 mg/L x 8.34	=	15.0 lb/day
7-d	Load = 0.060 mgd x 45 mg/L x 8.34	=	22.5 lb/day

TSS:

30-d	Load = 0.060 mgd x 45 mg/L x 8.34	=	22.5 lb/day
7-d	Load = 0.060 mgd x 65 mg/L x 8.34	=	32.5 lb/day

Outfall 002
BOD and TSS:

30-d	Load = 0.410 mgd x 30 mg/L x 8.34	=	102.6 lb/day
7-d	Load = 0.410 mgd x 45 mg/L x 8.34	=	153.9 lb/day

Table 4: Outfall 001 Technology-based Effluent Limits [1]

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Rational
BOD_5	mg/L	30	45	40 CFR 133.102 (a)
	lbs/day	15.0	22.5	
	% removal	85	NA	
TSS	mg/L	45	65	40 CFR 133.105 (b)
	lbs/day	22.5	32.5	
	% removal	65	NA	
pH	s.u.	6.0-9.0 (instantaneous)		40 CFR 133.102 (c)

1. See Definition section at end of permit for explanation of terms.

Table 5: Outfall 002 Technology-based Effluent Limits [1]

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Rational
BOD_5	mg/L	30	45	40 CFR 133.102 (a)
	lbs/day	102.6	153.9	
	% removal	85	NA	
TSS	mg/L	30	45	40 CFR 133.102 (b)
	lbs/day	102.6	153.9	
	% removal	85	NA	
pH	s.u.	6.0-9.0 (instantaneous)		40 CFR 133.102 (c)

1. See Definition section at end of permit for explanation of terms.

Nondegradation Load Allocations

The provisions of ARM 17.30.701 - 718 (Nondegradation of Water Quality) apply to new or increased sources of pollution [ARM 17.30.702(18)]. Outfall 002 is a new source for the purposes of nondegradation. ARM 17.30.702 defines “new or increased source” as an activity resulting in a change of existing water quality occurring on or after April 29, 1993. Outfall 001 is an existing source because it was in existence prior to that date. Sources that are in compliance with the conditions of their permit and do not exceed the limits established in the permit or determined from a permit previously issued by the Department are not considered new or increased sources.

Outfall 001

The Department calculated nondegradation loads in the 1994 permit renewal for the current facility (Outfall 001) for BOD_5, TSS, total nitrogen (TN) and total phosphorus as P (TP) using a design flow of 0.060 mgd (Table 1). The design flow used in the load calculation was not the design flow reported on the renewal application.

For Outfall 001, nondegradation load allocations and the actual average loads discharged from the facility for the period of record (POR) January 2001 through June 2006 are given in Table 6. Actual loads for BOD_5 and TSS were calculated from the self-monitoring data.

Table 6. Outfall 001 Nondegradation and Actual Loads for POR

Nondegradation Allocated Load Limits			Actual 30-day Average Loads (lb/day)					
Parameter	Units	Annual Average Load	2001	2002	2003	2004	2005	2006
BOD_5	lb/day	15	18.4	21.4	24.5	20.3	34.7	26.4
TSS	lb/day	50	25.8	25.6	43.3	25.9	32.4	30.2
TN	lb/day	16.8	--	--	--	--	--	--
TP	lb/day	4.2	--	--	--	--	--	--
The previous permit did not require the permittee to sample or report TN or TP data for the POR.								

<u>Outfall 002</u>
In terms of the Nondegradation policy, Outfall 002 is a new source. Effluent quality of Outfall 002 is subject to a non significance review, as required by 75-5-303, MCA and by rule at ARM 17.30.701-718 (Nondegradation of Water Quality). The nonsignificance review is detailed in Section IV.

IV. Water Quality-Based Effluent Limits

A. Scope and Authority

The Montana Water Quality Act (Act) states that a permit may only be issued if the Department finds that the issuance or continuance of the permit will not result in pollution of any state waters (75-5-401(2), MCA). ARM 17.30.1344(1) adopts by reference 40 CFR 122.44 which states that MPDES permits shall include limits on all pollutants which will cause, or have a reasonable potential to cause an excursion of any water quality standard, including narrative standards. The purpose of this section is to provide a basis and rationale for establishing effluent limits, based on Montana water quality standards, that will protect designated uses of the receiving stream.

Permits are required to include water-quality based effluent limits (WQBEL) when technology-based effluent limits are not adequate to protect state water quality standards (40 CFR 122.44 and ARM 17.30.1344). ARM 17.30.637(2) states that no wastes may be discharged that can reasonably be expected to violate any state water quality standards. Montana water quality standards (ARM 17.30.601 *et seq*.) define water use classifications for all state waters and both numeric and narrative standards that protect designated uses. New sources, as defined in ARM 17.30.703(16), are subject to Montana Nondegradation Policy (75-5-303, MCA) and regulations (ARM 17.30.701 *et. seq*).

In terms of the Nondegradation policy, Outfall 002 is a new source. It is subject to the Nondegradation policy, 75-5-303, MCA, which states that existing uses of state waters and the level of water quality necessary to protect those uses must be maintained and protected. And, unless authorized by the Department, the quality of high-quality water must be maintained. The Department may not authorize degradation of high-quality waters unless it as been affirmatively demonstrated by a preponderance of evidence to the Department that existing and anticipated use of state waters will be fully protected (75-5-303(3)(c), MCA).

B. Receiving Water

Outfall 001

Wastewater is discharged from the existing facility (Outfall 001) to a complex system of manmade irrigation ditches and canals. Treated effluent flows into a man-made channel that parallels the north lagoon embankment. Groundwater discharges into the ditch, upstream of the wastewater confluence, and creates perennial flow. The combined flow (effluent and groundwater) connects to another manmade channel.

Past permits have erroneously identified Mill Creek as the first named receiving water of Outfall 001. The discharge does not go into the Mill Creek drainage; rather it is diverted north into the Indian Creek drainage. The receiving water channel flows north and ultimately to Indian Creek. The previous permit statement of basis (SOB) was corrected to reflect Indian Creek as the receiving water. The SOB documents that during the summer, because Indian Creek is dewatered, effluent from the lagoon is the only water in Indian Creek.

The receiving water is classified as B-1 according to Montana Water Use Classifications, ARM 17.30.610**.** Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Outfall 002

Wastewater discharged from the proposed new facility (Outfall 002) will be to an unnamed tributary of the Leonard Slough, a wetland complex that flows into the Ruby River. The unnamed tributary and Leonard Slough are north of the Indian Creek drainage that Outfall 001 discharges. The receiving water is classified as B-1 according to Montana Water Use Classifications, ARM 17.30.610**.** Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

The unnamed tributary is a perennial stream, which gains a considerable flow from headwater to the Leonard Slough as a result of constant groundwater influx (personal communication with Kirk Engineering, November 2006). Aerial photos and ground reconnaissance revealed several small flowing streams merging in the same area (based on November 2006 MPDES inspection). Directly downstream of the proposed discharge point, the unnamed tributary merges with the

Left Fork of Leonard Slough, along with another unnamed tributary. Locally, the watershed has been significantly altered to accommodate irrigation via man-made channels and ditches. The channels and ditches deliver water for irrigation and offer drainage for groundwater and irrigation return flow.

Both of the receiving waters, the man-made ditch to Indian Creek (Outfall 001) and the unnamed tributary to Leonard Slough (Outfall 002), in the vicinity of the discharges are considered high quality water pursuant to Montana's Nondegradation Policy. High quality waters are those whose quality is higher than established standards and is defined at 75-5-103(10), MCA. Degradation of high quality water is not allowed unless authorized by the Department under 75-5-303(3), MCA.

Both receiving waters are located within the Ruby River watershed as identified by USGS Hydrological Unit Code (HUC) 1002003. Neither of the receiving waters have Montana stream segment IDs assigned. Neither receiving water in the proximity of the discharges is listed on the 1996 or 2006 303(d) lists of impaired streams.

Indian Creek, the downstream tributary to Outfall 001, was listed as impaired on the 1996 303(d) list based on flow alteration. The 2006 303(d) list shows that Indian Creek partially supports its aquatic life and cold-water fishery and primary contact recreational beneficial uses. Probable causes of impairment have been identified as alteration in stream-side or littoral vegetative covers, low flow alterations, and sedimentation/siltation. Municipal wastewater discharge was not identified as a probable source for any of the mentioned causes of impairment.

Leonard Slough was not listed as impaired on either the 1996 or 2006 303(d) list of impaired streams.

C. Applicable Water Quality Standards

Discharges to surface waters classified B-1 are subject to the specific water quality standards of ARM 17.30.623 (March 31, 2006), Department Circular DEQ-7 (February 2006), as well as the general provision of ARM 17.30.635 through 637. In addition to these standards, dischargers are also subject to ARM 17.30 Subchapter 5 (Mixing Zones, November 2004) and Subchapter 7 (Nondegradation of Water Quality, June 30, 2004).

ARM 17.30.635(4) states that the design condition for disposal systems must be based on the 7-day average flow of the receiving water which is expected to occur on average once in 10 years (7Q10). More restrictive requirements may be necessary due to specific mixing zone requirements.

Pollutants typically present in domestic-dominated lagoon effluent that could exceed water quality standards include *Escherichia coli* (*E. coli*) bacteria, total ammonia as nitrogen, nutrients, low levels of dissolved oxygen (DO), and total residual chlorine when used to control pathogens.

Outfall 001

***Escherichia coli* Bacteria-** Montana water quality standards were revised to replace fecal coliform bacteria with *Escherichia coli (E. coli*) to reflect the latest federal guidance. Applicable standards for *E. coli* are:

> April 1 through October 31 of each year - the geometric mean number of *E. coli* must not exceed 126 colony forming units (cfu) per 100 milliliters (ml) and 10% of the total samples may not exceed 252 cfu per 100 ml during any 30-day period [ARM 17.30.625(2)(a)(i)]; and
>
> November 1 through March 31 of each year - the geometric mean number of *E. coli* must not exceed 630 cfu per 100 ml and 10% of the total samples may not exceed 1,260 cfu per 100 ml during any 30-day period [ARM 17.30.625(2)(a)(ii)].

Total Ammonia as N - Standards for total ammonia are pH and temperature dependent. Standard calculations are outlined in the Department Circular, DEQ-7 (February 2006). Total ammonia standards are further defined as acute one-hour average (CMC) and chronic 30-day average (CCC) criterion. The fishery present and associated life stages are also taken into consideration for ammonia standard calculations.

Ambient receiving water quality data are limited. Instream pH and temperature data were collected by Department staff during two MPDES compliance inspections. Table 7 provides field parameters and calculated receiving water total ammonia standards. The presence of fish and/or the potential of the receiving water to support fish has not been assessed. However, to be most protective, the most restrictive water quality standards for total ammonia were applied; these are for streams where salmonids and early life stages (fish) are present.

Table 7: Outfall 001 Ammonia standard calculations [1]

Date	Water pH (s.u.)	Water temperature (°F)	Water Quality Standard, Total Ammonia as N (mg/L)		Flow
			CMC	CCC	cfs
Apr. 2, 2004	7.5	43.2	12.9	4.3	0.17 [2]
Nov. 11, 2006	6.5	48.4	32.5	6.7	Not assessed

(1) Based on Department Circular WQB-7 (February 2006)
(2) Visually estimated flow was reported as 75-100 gpm. The low end was converted to cfs and presented in table.

Dissolved Oxygen (DO) – Freshwater aquatic life standards are characterized by the fishery (cold- or warm-water) and by the presence or absence of fish early life stages. Standards are further defined based on a time frame and required DO levels. B-1 waterbody classification states the receiving waters are cold-water fisheries. DO standards for B-1 waters are given in Table 8.

Table 8: B-1 Water Classification DO Standards				
Dissolved Oxygen (mg/L)	30-Day Mean	7-Day Mean	7-Day Mean Minimum[3]	1-Day Minimum[3]
Early Life Stages[1,2]	N/A	9.5	N/A	8.0
Other Life Stages	6.5	N/A	5.0	4.0

Footnotes:
N/A – "not applicable"
1. These are water column concentrations recommended to achieve the required inter-gravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the figures in parentheses apply.
2. Includes all embryonic and larval stages and all juvenile forms of fish to 30-days following hatching.
3. All minima should be considered as instantaneous concentrations to be achieved at all times.

Outfall 002

Outfall 002 is a new source and the nondegradation rules specify applicable water quality standards (ARM 17.30.701-718). The Department review of proposals for new or increased sources will determine the level of protection required for the impacted water, based on: a) existing and anticipated used and the water quality necessary to protect those uses must be maintained and protected; and b) degradation may be allowed only according to the procedures in ARM 17.30.708. These rules apply to any activity that may cause degradation of high quality waters, for any parameter, unless the changes in existing water quality resulting from the activity are determined to be nonsignificant under ARM 17.30.715 or 17.30.716.

ARM 17.30.715 states criteria that are used to determine nonsignificance. These criteria consider the quality and strength of the pollutant, the length of time the changes will occur, and the character of the pollutant. For a surface water discharge to be considered nonsignificant, it must meet all of the following criteria:

1. Activities that would increase or decrease the mean monthly flow of a surface water by less than 15% or the 7Q10 by less than 10%;
2. Discharge containing carcinogenic parameters or parameters with a bioconcentration factor greater than 300 at concentrations less than or equal to the concentrations of the parameters in the receiving water;
3. Discharge containing toxic parameters or nutrients which will not cause changes that equal or exceed the trigger values in DEQ-7. Whenever the change exceeds the trigger value, the change is not significant if the resulting concentration outside a department designated mixing zone does not exceed 15% of the lowest applicable standard.
4. Changes in the water quality for any harmful parameter for which water quality standards have been adopted other than nitrogen, phosphorus, and carcinogenic, bioconcentrating, or toxic parameter, if the changes outside the mixing zone is less than 10% of the applicable standard and the existing water quality level is less than 40% of the standard.
5. Changes in the water quality for any parameter for which only a narrative standard exists if the changes will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

Even if the trigger value is exceeded, a source may still be considered nonsignificant if the parameter of concern does not exceed 15% of the lowest applicable standard outside the mixing zone [ARM 17.30.715(1)(c)].

Pollutants that are present in domestic wastewater that will be subject, but are not limited to, nonsignificance review are DO, total ammonia, and nutrients (TN and TP).

***Escherichia coli* Bacteria -** Montana water quality standards were revised to replace fecal coliform bacteria with *Escherichia coli (E. coli*) to reflect the latest federal guidance. Standards given for B-1 classified water are:

> April 1 through October 31 of each year - the geometric mean number of *E. coli* must not exceed 126 colony forming units (cfu) per 100 milliliters (ml) and 10% of the total samples may not exceed 252 cfu per 100 ml during any 30-day period [ARM 17.30.625(2)(a)(i)]; and
>
> November 1 through March 31 of each year - the geometric mean number of *E. coli* must not exceed 630 cfu per 100 ml and 10% of the total samples may not exceed 1,260 cfu per 100 ml during any 30-day period [ARM 17.30.625(2)(a)(ii)].

E. coli bacteria is characterized as a harmful pollutant in DEQ-7 (2006). The nonsignificance criteria in ARM 17.30.715(1)(f) states that a harmful pollutant, which a water quality standard has been adopted, is considered nonsignificant if the change outside the mixing zone is less than 10 percent of the applicable standard and the water quality level in the receiving water is less than 40 percent of the standard. The Department is not granting a mixing zone for *E. coli* bacteria because the potential for contact recreation, and ARM 17.30.637(1)(e) which requires that state waters must be free from substances that are harmful or toxic to humans. Ten percent of the lowest applicable *E. coli* standard is 13 cfu for the period of April 1 through October 31, and 63 cfs for the period of November 1 through March 31.

Nutrients – DEQ-7 lists trigger values for total inorganic nitrogen as 0.01 mg/L; this value will be used for the trigger value for TN. The trigger value given in DEQ-7 for TP is 0.001 mg/L. The contracting engineer for the permittee collected background samples in December 2006. Two samples were analyzed, one as a duplicate, and were averaged for use in limit derivation. For ambient conditions, the average TN is 1.71 mg/L and the average TP is 0.023 mg/L.

Total Ammonia as N – Standards for toxic pollutants found in new sources are determined by following ARM 17.30.715, which has the criteria for determining nonsignificant changes in water quality. An activity that is considered nonsignificant can not cause a change that equals or exceeds the trigger value listed in DEQ-7, which is 0.01 mg/L for total ammonia as N. Whenever a changes exceeds the trigger value, the change is not significant if the resulting concentration at outside the mixing zone does not exceed 15% of the lowest applicable standard, stated by ARM 17.30.715(1)(c).

A one-time sampling event collected continuously measured pH and water temperature from the unnamed tributary to the Leonard Slough from December 20 – 27, 2006 (data recorder time increment was 10 minutes). The median pH (8.0) and water temperature (36.0°F) data were used to calculate total ammonia as N standards following DEQ-7. The calculated standards were: CMC = 5.62 mg/L and CCC = 2.43 mg/L. Fifteen percent of the lowest standard, the calculated CCC, is 0.36 mg/L.

Dissolved Oxygen (DO) – The DO standards in Table 8 apply.

D. Mixing Zone

A mixing zone is an area where the effluent mixes with the receiving water and certain water quality standards may be exceeded [ARM 17.30.502(6)]. The Department must determine the applicability of currently granted mixing zones [ARM 17.30.505(1)]. Mixing zones allowed under a permit issued prior to April 29, 1993 will remain in effect unless there is evidence that previously allowed mixing zones will impair existing or anticipated uses [ARM 17.30.505(1)(c)].

In accordance with ARM 17.30.517(1)(b), acute water quality standards for aquatic life may not be exceeded in any portion of the mixing zone unless the Department finds that allowing minimal initial dilution will not threaten or impair existing uses. The discharge must also comply with the general prohibitions of ARM 17.30.637(1) which require that state waters, including mixing zones, must be free from substances which will:

(a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
(b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;
(c) produce odors, colors or other conditions as to which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
(d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; and
(e) create conditions which produce undesirable aquatic life.

Although certain standards may be exceeded in the mixing zone, an effluent in its mixing zone may not block passage of aquatic organisms nor may it cause acutely toxic conditions [ARM 17.30.602(16)]. No mixing zone will be granted that will impair beneficial uses [ARM 17.30.506(1)]. Acute standards may not be exceeded in any part of the mixing zone [ARM 17.30.507(1)(b)]. Aquatic life chronic, aquatic life acute and human health standards may not be exceeded outside of the mixing zone [ARM 17.30.507(1)(a)].

A standard mixing zone may be granted for facilities which discharge less than 1 mgd or when mixing is nearly instantaneous [ARM 17.30.516(d)]. Nearly instantaneous mixing is assumed if the discharge is through an effluent diffuser, when the mean daily flow exceeds the 7-day, 10-year low flow (dilution ratio <1) or the permittee demonstrates through a Department approved study plan that the discharge is nearly instantaneous. A nearly instantaneous mixing zone may not extend downstream more than two (2) river widths.

Effluent discharges which do not qualify for a standard mixing zone must apply for a source specific mixing zone in accordance with ARM 17.30.518 and must conform to the requirements of 75-5-301(4), MCA which states that mixing zones must be the smallest practicable size; have minimal effects on uses; and, have definable boundaries. ARM 17.30.515(2) states that a person applying for a mixing zone must indicate the type of mixing zone and provide sufficient detail for the Department to make a determination regarding the authorization of the mixing zone under the rules of Subchapter 5.

Outfall 001

No effluent limits are proposed for Outfall 001 that require a mixing zone.

The previous permit identified a mixing zone for Outfall 001 as "nearly instantaneous…due to a dilution ratio of 2:1". ARM 17.30.516(3)(d) states that nearly instantaneous mixing will be assumed when the mean daily flow of the discharge exceeds the 7Q10 low flow of the receiving water. Nearly instantaneous mixing is assumed to occur when there is less than a 10% difference in bank-to-bank concentrations at a distance less than 2 stream widths downstream.

A calculated 7Q10 flow for the man-made ditch is unknown at present and was not documented in the previous permit. The permittee provided data from a one-time flow measurement of 0.183 cubic feet per second (cfs) or 82.3 gpm collected in January 2005. The dilution ratio of the receiving water to the discharge is closer to 1:1, assuming this value represents a low-flow scenario. When the design discharge from the application is used (0.144 mgd or 0.22 cfs), the dilution ratio is 0.8, or the effluent flow rate exceeds that in the ditch.

Outfall 002

The permittee reported that, at the planned point of discharge, flow in the tributary is 3.1 cfs (2.0 mgd). The application for the discharge states that the design discharge is 0.6 cfs (0.41 mgd). No other flow data has been made available for the receiving water. In the absence of any other flow data, the December 2006 flow will be assumed as the critical low flow. The dilution ratio is 4.9.

During permit development, the Department may determine whether a mixing zone is appropriate. The Department may grant a standard mixing zone where one is appropriate. ARM 17.30.516(3)(b) states that a standard mixing zone may be applied to a facility whose discharge is less than one mgd to a stream segment with a dilution less than 100:1. Discharge limitations are based on dilution with 25% of the 7Q10. The water volume available for the standard mixing zone is 0.8 cfs (25% of 3.1 cfs).

E. Basis and Proposed Water Quality-Based Effluent Limits

Pollutants typically present in municipal wastewater that may cause or contribute to a violation of water quality standards include conventional pollutants such as biological material (measured by BOD_5), suspended solids, oil & grease, *Escherichia coli (E. coli)* bacteria and pH; nonconventional pollutants such as chlorine, ammonia, nitrogen and phosphorus; and toxics such as metals and organics.

ARM 17.30.1345 requires WQBELs to be developed for any pollutant for which there is reasonable potential (RP) for discharges to cause or contribute to exceedances of in-stream numeric or narrative water quality standards. The Department uses a mass balance equation to determine reasonable potential based on the *EPA Technical Support Document for Water Quality based Toxics Control (TSD) (EPA/505/2-90-001)*. RP calculations utilize the receiving water concentration, the maximum effluent concentration, the design flow of the wastewater treatment facility, and the applicable receiving water flow. The Department is proposing effluent limits for certain pollutants for which adequate data exists.

The Department uses a mass balance equation to determine RP (*Equation 1*).

$$C_{RP} = \frac{C_E Q_E + C_S Q_S}{Q_E + Q_S} \qquad \textit{(Eq. 1)}$$

Where:

C_{RP} = receiving water concentration (RWC) after mixing, mg/L
C_E = maximum effluent concentration, mg/L
C_S = RWC upstream of discharge, mg/L
Q_S = applicable receiving water flow, cfs
Q_E = facility design flow rate, cfs

Outfall 001

1. Conventional Pollutants

The existing facility was designed to provide significant reduction in biological material and solids through secondary treatment (Section III). No additional WQBEL will be required for these parameters (BOD_5, TSS and pH).

***Escherichia coli* Bacteria–** Pathogen effluent samples for the existing facility have not been regularly collected. A single pathogen sample, as measured by fecal coliform bacteria, is on file that was collected during an April 2004 Department compliance inspection. The fecal coliform sample result was 3 org/100 mL. The ability of the existing system to consistently meet effluent pathogen limits cannot be determined based on one sample. The facility is hydrologically overloaded and detention time is decreased, so low effluent pathogen levels may be the result of dilution, rather than treatment.

2. Non-conventional Pollutants

Total Residual Chlorine (TRC) - Chlorine is not utilized by the existing facility. Chlorine limits are not necessary. If chlorine disinfection is proposed in the future, the permittee must submit a new EPA 2A application and applicable fees and request a modification to the existing permit.

Total Ammonia as N – The previous permit did not require the permittee to sample ammonia in the effluent. Monitoring will be required for total ammonia in the effluent during this permit cycle.

Dissolved Oxygen (DO) – Typically, facilities that provide significant removal of organic material, as measured by BOD_5, do not require effluent limits for DO.

3. Toxic Pollutants

Whole Effluent Toxicity (WET) and organic effluent limits will not be required in this permit due to the absence of significant industrial contributors to the system. WET monitoring will be required on the discharge during the calendar year 2010.

Total recoverable metals analysis are required in the third and fourth year of the permit cycle (2010 and 2011) because they are required parameters in the permit renewal application.

Outfall 002

1. Conventional Pollutants

The proposed new facility is designed to provide significant reduction in biological material and solids through secondary treatment (Section III). No additional WQBEL will be required TSS and pH. Effluent requirements for BOD_5 are discussed in terms of dissolved oxygen analysis in the receiving water.

***Escherichia coli* Bacteria –** Discharge from Outfall 002 is required to meet that standard at the end of treatment. The standards using nonsignificant criteria are 13 cfu/100 mL and 63 cfu/100 mL for the summer and winter periods, respectively. The application on file for the new facility indicates that UV disinfection will be used to meet these limits.

2. Non-conventional Pollutants

Total Residual Chlorine (TRC) – Chlorine disinfection is not proposed for the new facility. The permit application for the new facility states ultra violet (UV) disinfection will be used at Outfall 002. Chlorine limits are not necessary. If chlorine disinfection is proposed in the future, the permittee must submit an updated EPA 2A application and request a modification to the existing permit.

Nutrients – Equation 1 was solved for the concentration in the effluent (C_E) to calculate TN and TP effluent limits. The applicable trigger values from DEQ-7 were added to the average December 2006 water quality results for TN and TP. The sums represented the maximum allowable increases in the receiving water downstream of the discharge.

$$C_E = \frac{CrQr - C_S Q_S}{Q_E}$$

Where:
C_E = TN or TP effluent limit, mg/L
C_r = Combined downstream concentration or average background + trigger value, mg/L
Q_r = Combined downstream discharge, cfs
C_S = RWC upstream of discharge, mg/L
Q_S = applicable receiving water flow, cfs
Q_E = facility design flow rate, cfs

The resulting effluent limit for TN (C_E) is 1.77 mg/L. Values used for the TN limit calculation are:

C_r = 1.72 mg/L
Q_r = 3.73 cfs
C_S = 1.71 mg/L
Q_S = 3.1 cfs
Q_E = 0.63 cfs

The resulting effluent limit for TP (C_E) is 0.029 mg/L. Variables used for the TP limit calculation are:

C_r = 0.024 mg/L
Q_r = 3.73 cfs
C_S = 0.023 mg/L
Q_S = 3.1 cfs
Q_E = 0.63 cfs

Aerated lagoons are not designed to provide controllable reductions in nutrients. The effluent quality can not consistently meet a quality to meet the given limits. The permittee is not allowed to discharge to surface water during the growing season from May 1 through September 30.

Total Ammonia as N – The receiving water volume is low relative to the design discharge flow rate. Aerated lagoons in Montana typically discharge total ammonia as N values in excess of 15 mg/L during cold winter months. Therefore, RP is assumed to exist for the proposed facility. Total ammonia limits are necessary.

Effluent limits are applicable October 1 through April 30. Effluent limits were calculated using the method described in the TSD document (EPA, 1991). Values used in the calculation and the resulting limits are provided in Appendix A. The average monthly limit is 0.4 mg/L and the daily maximum limit is 0.6 mg/L.

Based on data from aerated lagoons in Montana, the above stated limits cannot be consistently achieved without added treatment. No discharge is allowed from May 1 through September 30.

Dissolved Oxygen (DO) – National secondary treatment requirements are aimed at reducing organic material that creates an oxygen demand in the receiving water. Typically, facilities that provide significant removal of organic material, as measured by BOD_5, do not require effluent limits for DO.

The 30-day average national secondary treatment requirement for BOD_5 was analyzed using the Streeter-Phelps equation (Thomann and Mueller, 1987; EPA, 1999) to determine if the BOD_5 limit would cause a DO sag and a violation of the DO standards. The Streeter-Phelps equation is a conservative steady-state equation that assumes a plug flow, and does not consider longitudinal diffusion from the plug. The equation makes simplifying assumptions limited to only point source contributions of biochemical oxygen demand. All other influences on the receiving water DO (photosynthesis, respiration, sediment oxygen demand) are assumed to be zero (EPA, 1999).

Design parameters, assumed effluent quality, and actual receiving water data were used in the Streeter-Phelps equation. Assumptions for re-aeration and deoxygenation rates were made using EPA guidance and text book theoretical values. All assumptions, variables, and the complete equation are documented in Appendix B. The equation uses Ultimate Oxygen Demand, UOD, which is the sum of CBOD (carbonaceous biochemical oxygen demand) and the oxygen demand required to convert effluent total ammonia to nitrate (UOD = CBOD + O_2 required for $NH_4 \rightarrow NO_{2/3}$).

The Streeter-Phelps equation predicts a downstream DO deficit, represented in this discussion and the equation as D_c. The following equation was used to determine the final D_c:

$$D_c = D_o e^{-K_a t} + \frac{W}{Q}\left(\frac{K_d}{K_a - K_r}\right)[e^{-K_r t} - e^{-K_a t}]$$

The initial receiving water DO deficient, D_o, is assumed to be zero. Therefore, the first term, $D_o e^{-K_a t}$, is zero and removed from the equation.

The total pollutant loading rate, W, is UOD multiplied by the facility design discharge rate then multiplied by a unit conversion factor (8.34 lb*L/mg*gal). For Outfall 002, the following assumptions were made to determine UOD:

1) The national secondary standard for CBOD of 25 mg/L was used;
2) CBOD was multiplied by a textbook value of *f*, an estimated ratio of ultimate CBOD to $CBOD_5$; for secondary treatment, *f* = 1.6 (Thomann and Mueller);
3) An estimated average winter ammonia as N value of 10 mg/L was used for the nitrogenous component because data have not been generated for the proposed facility; and
4) The total ammonia as N multiplied by 4.57, or the total oxygen used to convert ammonia to nitrate.

UOD is 85.7 mg/L (UOD = 25 mg/L*1.7 + 10 mg/L*4.57 = 85.7 mg/L); and
W is 293 lb/day (W=UOD*design discharge rate*8.34 = 85.7*0.41mgd*8.34 = 293 lb/day).

In the equation, K represents rate values; these values are K_d = BOD deoxygenation rate, K_a= atmospheric re-aeration rate, and K_r = BOD loss rate. The rates were calculated using actual field data specific to Outfall 002 and theoretical values recommended by the EPA (1995). Values determined and details for each are provided in Appendix B.

For Outfall 002, D_c is 2.5 mg/L. The next step is to estimate the downstream impact of D_c on the receiving water DO and compare the result to DO standards in Table 8. If the downstream DO concentration is less than the standards, the effluent BOD_5 limit must be adjusted. For this analysis, the 1-day minimum DO concentration for early life stages, which is 8.0 mg/L, is considered to be the most restrictive standard.

The minimum allowable DO is a function of the receiving water DO saturation, which is dependant on temperature, salinity, and atmospheric pressure (corrected for elevation). Salinity data is unknown for the receiving water. However, fresh water salinity typically is less than 0.5 parts per thousand (ppt). Assuming this salinity (S) gives a chlorinity of approximately zero (S = 1.80655*chlorinity; Thomann and Mueller, 1987); therefore, the effects of salinity on c_s are negligible. The values and assumptions used to determine c_s are explained in Appendix B. Thomann and Mueller (1987) have tabulated c_s values calculated *at sea level* for temperature and salitity. A correction factor of 83% c_s was calculated to account for the elevation above sea level of the receiving water. From the tabulated values, when the receiving water temperature is 5°C, the corresponding c_s is 10.6 mg/L. Correcting for elevation, c_s is 8.8 mg/L (83% of 10.6 mg/L). The DO deficit in the receiving water is 6.1 mg/L found from D_c (2.7 mg/L) subtracted from c_s (8.8 mg/L – 2.7 mg/L=6.1 mg/L). The resultant receiving water DO is less than 8.0 mg/L, or the 1-day minimum DO standard for aquatic early life stages (Table 8). At the assumed effluent loading conditions, the effluent BOD_5 must be reduced to meet DO requirements.

The following ratio was used to determine a final effluent BOD_5 limit that will satisfy D_c(allowable). The ratio is solved for UOD_e (allowable), which is the resulting 30-day BOD_5 limit:

$$\frac{D_c}{UOD_e} = \frac{D_c(allowable)}{UOD_e(allowable)}$$

Where: D_c = DO deficit = 0.4 mg/L
UOD_e = effluent UOD at national secondary standards = 85.7 mg/L
D_c (allowable) = allowable DO deficit = 0.5 mg/L
UOD_e (allowable) = allowable effluent UOD limit = 13 mg/L

The UOD_e was calculated for the Streeter-Phelps calculation and was described above.

The allowable DO deficit, D_c(allowable), is determined by subtracting the standard from the c_s at 15°C (which is 8.4 mg/L). The c_s at 15°C is significant because resulting c_s at temperatures greater than 15°C exceed the 1-day standard. The allowable DO deficit is: c_s – 1-day DO standard = 8.4 mg/L – 8.0 mg/L = 0.4 mg/L.

UOD_e (allowable) is 13 mg/L and is the 30-day limit for BOD_5. The 7-day limit is 1.5 times the 30-day limit, or 20 mg/L. The 7-day limit multiplier is recommended by federal regulation at 40 CFR 133.(1)(f). BOD_5 loads are calculated as:

30-day load: 13 mg/L * 0.41 mgd * 8.34 = **44.5 lb/day**
7-day load: 20 mg/L * 0.41 mgd * 8.34 = **68.4 lb/day**

3. Toxic Pollutants

WET monitoring will be required on the discharge during the calendar year 2010. Acute WET monitoring is required due to the low receiving water dilution and low receiving water standards.

Total recoverable metals scans are required in the third and fourth year full calendar years (2010 and 2011) of the permit cycle because they are required parameters in the permit renewal application.

V. Proposed Effluent Limits

Outfall 001 – Interim Effluent Limits, effective through March 31, 2012				
Parameter	**Units**	**Average Monthly** [1]	**Average Weekly** [1]	**Maximum Daily** [1]
Biological Oxygen Demand (BOD_5)	mg/L	30	45	--
	lbs/day	15.0	22.5	--
Total Suspended Solids (TSS)	mg/L	45	65	--
	lbs/day	22.5	32.5	--

Footnotes:
1. See Definition section, Part V of MPDES permit, for explanation of terms.

Outfall 001 – Final Effluent Limits, effective April 1, 2012				
Parameter	**Units**	**Average Monthly** [1]	**Average Weekly** [1]	**Maximum Daily** [1]
Biological Oxygen Demand (BOD_5)	mg/L	30	45	--
	lbs/day	15.0	22.5	--
Total Suspended Solids (TSS)	mg/L	45	65	--
	lbs/day	22.5	32.5	--
E. coli – Summer [2, 3]	cfu/100-mL	126	--	252
E. coli – Winter [2, 3]	cfu/100-mL	630	--	1,260

Footnotes:
1. See Definition section, Part V of MPDES permit, for explanation of terms.
2. Summer is defined as April 1 through October 31; winter is defined as November 1 through March 31.
3. Report Geometric Mean if more than one sample is collected in the reporting period.
4. Total ammonia limit is effective October 1 through April 30.

In addition to the above numeric limits, the effluent will meet the following narrative limits, effective immediately and lasting through the term of the permit:

Effluent pH shall remain between 6.0 and 9.0 unless a variation is due to natural biological processes. For compliance purposes, any single analysis and/or measurement beyond this limitation shall be considered a violation of the conditions of this permit.

85 Percent (%) Removal Requirement for BOD_5:
The arithmetic mean of the BOD_5 for effluent samples collected in a period of 30 consecutive days shall not exceed 15% of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (85% removal). This is in addition to the concentration limitations on BOD_5.

65 Percent (%) Removal Requirement for TSS:
The arithmetic mean of the TSS for effluent samples collected in a period of 30 consecutive days shall not exceed 35% of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (65% removal). This is in addition to the concentration limitations on TSS.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

There shall be no discharge which causes visible oil sheen in the receiving stream.

Outfall 002 – Final Effluent Limits

Parameter	Units	Average Monthly [1]	Average Weekly [1]	Maximum Daily [1]
Biological Oxygen Demand (BOD_5)	mg/L	13	44.5	--
	lbs/day	20	68.5	--
Total Suspended Solids (TSS)	mg/L	30	45	--
	lbs/day	102.6	153.9	--
E. coli – Summer [2, 3]	cfu/100-mL	13	--	26
E. coli – Winter [2, 3]	cfu/100-mL	63	--	126
Total Ammonia as N [4]	mg/L	0.40	--	0.50

Footnotes:
1. See Definition section, Part V of MPDES permit, for explanation of terms.
2. Summer is defined as April 1 through October 31; winter is defined as November 1 through March 31.
3. Report Geometric Mean if more than one sample is collected in the reporting period.
4. Total ammonia limit is effective October 1 through April 30.

No discharge is allowed from May 1 through September 30.

85 Percent (%) Removal Requirement for BOD_5:
The arithmetic mean of the BOD_5 for effluent samples collected in a period of 30 consecutive days shall not exceed 15% of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (85% removal). This is in addition to the concentration limitations on BOD_5.

85 Percent (%) Removal Requirement for TSS:
The arithmetic mean of the TSS for effluent samples collected in a period of 30 consecutive days shall not exceed 15% of the arithmetic mean of the values for influent samples collected at approximately the same times during the same period (85% removal). This is in addition to the concentration limitations on TSS.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

There shall be no discharge which causes visible oil sheen in the receiving stream.

VI. Monitoring Requirements

A. Effluent Monitoring

Effluent monitoring for Outfall 001 shall be conducted at the discharge pipe. Effluent monitoring for Outfall 002 will be conducted at the effluent weir (Figure 1).

Outfall 001 Interim Monitoring Requirements, effective immediately and lasting through December 31, 2011

Parameter	Unit	Sample Location	Sample Frequency	Sample Type[1]
Flow	mgd	Effluent	3/Week	Instantaneous
5-Day Biological Oxygen Demand (BOD_5)	mg/L	Effluent	1/Week	Grab
	lbs/day	Effluent	1/Month	Calculated
Total Suspended Solids (TSS)	mg/L	Effluent	1/Week	Grab
	lbs/day	Effluent	1/Month	Calculated
pH	s.u.	Effluent	1/Month	Instantaneous
Temperature	°C	Effluent	1/Month	Instantaneous
E. coli Bacteria	CFU/100ml	Effluent	1/Month	Grab
Oil and Grease [2]	mg/L	Effluent	1/Quarter	Grab
Total Ammonia, as N	mg/L	Effluent	1/Month	Grab
Nitrate + Nitrite, as N	mg/L	Effluent	1/Month	Grab
Kjeldahl Nitrogen, Total, as N	mg/L	Effluent	1/Month	Grab
Total Nitrogen, as N [3]	mg/L	NA	1/Month	Calculated
	lbs/day	NA	1/Month	Calculated
Total Phosphorus, as P	mg/L	Effluent	1/Month	Grab
	lbs/day	NA	1/Month	Calculated
Total Dissolved Solids (TDS)	mg/L	Effluent	1/Quarter	Grab
Dissolved Oxygen	mg/L	Effluent	1/Month	Instantaneous

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. Use EPA Method 1664, Revision A: N-Hexane Extractable Material (HEM), or equivalent.
3. Calculated as the sum of Nitrate + Nitrite (as N) and Total Kjeldahl Nitrogen (as N) concentrations.

Outfall 001 Final Monitoring Requirements, effective January 1, 2012				
Parameter	Unit	Sample Location	Sample Frequency	Sample Type[1]
Flow	mgd	Effluent	3/Week	Instantaneous
5-Day Biological Oxygen Demand (BOD_5)	mg/L	Influent	1/Month	Composite
	mg/L	Effluent	1/Week	Grab
	% Removal[4]	Effluent	1/Month	Calculated
	lbs/day	Effluent	1/Month	Calculated
Total Suspended Solids (TSS)	mg/L	Influent	1/Month	Composite
	mg/L	Effluent	1/Week	Grab
	% Removal[4]	Effluent	1/Month	Calculated
	lbs/day	Effluent	1/Month	Calculated
pH	s.u.	Effluent	1/Month	Instantaneous
Temperature	°C	Effluent	1/Month	Instantaneous
E. coli Bacteria	CFU/100ml	Effluent	1/Week	Grab
Total Residual Chlorine[2]	mg/L	Effluent	Daily	Grab
Oil and Grease[5]	mg/L	Effluent	1/Quarter	Grab
Total Ammonia, as N	mg/L	Effluent	1/Month	Grab
Nitrate + Nitrite, as N	mg/L	Effluent	1/Month	Grab
Kjeldahl Nitrogen, Total, as N	mg/L	Effluent	1/Month	Grab
Total Nitrogen, as N[3]	mg/L	Effluent	1/Month	Calculated
	lbs/day	Effluent	1/Month	Calculated
Total Phosphorus, as P	mg/L	Effluent	1/Month	Grab
	lbs/day	Effluent	1/Month	Calculated
Total Dissolved Solids (TDS)	mg/L	Effluent	1/Quarter	Grab
Dissolved Oxygen	mg/L	Effluent	1/Month	Instantaneous

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. The Permittee is only required to sample for total residual chlorine if chlorine is used as a disinfectant in the treatment process. If chlorine is *not* used, write "NA" on the DMR for this parameter.
3. Calculated as the sum of Nitrate + Nitrite (as N) and Total Kjeldahl Nitrogen (as N) concentrations.
4. See narrative discussion in this section of permit for additional details.
5. Use EPA Method 1664, Revision A: N-Hexane Extractable Material (HEM), or equivalent.

Outfall 002 Monitoring Requirements				
Parameter	Unit	Sample Location	Sample Frequency	Sample Type[1]
Flow	mgd	Effluent	3/Week	Instantaneous
5-Day Biological Oxygen Demand (BOD_5)	mg/L	Influent	1/Month	Composite
	mg/L	Effluent	1/Week	Composite
	% Removal[2]	Effluent	1/Month	Calculated
	lbs/day	Effluent	1/Month	Calculated
Total Suspended Solids (TSS)	mg/L	Influent	1/Month	Composite
	mg/L	Effluent	1/Week	Composite
	% Removal[2]	Effluent	1/Month	Calculated
	lbs/day	Effluent	1/Month	Calculated
pH	s.u.	Effluent	1/Week	Instantaneous
Temperature	°C	Effluent	1/Week	Instantaneous
E. coli Bacteria	No./100ml	Effluent	1/Week	Grab
Oil and Grease[3]	mg/L	Effluent	1/Quarter	Grab
Total Ammonia, as N	mg/L	Effluent	1/Week	Grab
Nitrate + Nitrite, as N	mg/L	Effluent	1/Quarter	Grab
Kjeldahl Nitrogen, Total, as N	mg/L	Effluent	1/Quarter	Grab
Total Nitrogen, as N[4]	mg/L	Effluent	1/Quarter	Calculated
	lbs/day	Effluent	1/Quarter	Calculated
Total Phosphorus, as P	mg/L	Effluent	1/Quarter	Grab
	lbs/day	Effluent	1/Quarter	Calculated
Total Dissolved Solids (TDS)	mg/L	Effluent	1/Quarter	Grab
Dissolved Oxygen	mg/L	Effluent	1/Week	Grab
Whole Effluent Toxicity, Acute[2]	% Effluent	Effluent	1/Quarter	Grab

Footnotes:
1. See Definition section at end of permit for explanation of terms.
2. See narrative discussion in this section of permit for additional details.
3. Use EPA Method 1664, Revision A: N-Hexane Extractable Material (HEM), or equivalent.
4. Calculated as the sum of Nitrate + Nitrite (as N) and Total Kjeldahl Nitrogen (as N) concentrations.

B. Whole Effluent Toxicity (WET) Requirements

WET testing is required beginning in the **first calendar quarter of 2010.** The permittee shall conduct an acute static replacement toxicity test on a grab sample of the effluent. Testing will employ two species per monitoring period and will consist of 5 effluent concentrations (100, 50, 25, 12.5, 6.25 percent effluent) and a control. Dilution water and the control shall consist of the receiving water. The permittee will collect a total of four samples, separate calendar quarters, during the fourth full calendar year (2010) of the permit. Refer to the MPDES permit, Part I.C. for more information.

V. Special Conditions/Compliance Schedules

ARM 17.30.1342 (8) requires that the permittee furnish to the Department, within a reasonable time, any information to determine compliance with this permit. The following conditions must be met within the given timeframe:

A. Nutrient Management Plan – The permittee proposes to use land application for Outfall 002 effluent from May 1 through September 30. Effluent is required to be treated to meet national secondary treatment requirements and disinfected using UV prior to irrigation.

A nutrient management plan (NMP) is a best management practice established under the authority of 40 CFR 122.44(k) to require practices reasonably necessary to meet the intent of the federal Clean Water Act. The NMP will be developed in accordance with requirements in Appendix C and those specified by the permit.

i) Authority: ARM 17.30.1344(1) which states that each MPDES permit must include conditions meeting the requirements stated in 40 CFR 122.44. The federal reference at 40 CFR 122.44(k) states that best management practices (BMP) are necessary "to control or abate the discharge of pollutants when:…(4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purpose and intent of the (Clean Water Act)".

ii) Schedule: By December 31, 2007, the permittee will submit a site-specific NMP to the Department. The NMP must be signed by the principle executive officer in accordance with Part IV.G. "Signatory Requirements" of the MPDES permit. The permittee must amend the NMP at a minimum of once every five years. However, the NMP must reflect current operational characteristics and practices, so the NPM may have to be amended more frequently. The current NMP will be retained on site, in accordance to Part II.H "Retention of Records" in the MPDES permit.

iii) The minimum elements required in the NMP are:

a. Estimate the volume of wastewater generated;
b. A description of the size and volume capacity of all facilities;
c. A description of the BMPs implemented to control the runoff of pollutants from the land application area to state waters;
d. Guidance for implementation, operation, maintenance, and record keeping;
e. A detailed description of area(s) where wastewater will be applied. The description must have
    i. An aerial photo or map and a soil map
    ii. Location of any down-gradient surface waters, open tile line intake structures, sinkholes, agricultural well heads, or other conduits to surface water, current and/or planned plant production sequence or crop rotation or irrigated crop
    iii. Realistic yield goals for the crops in the rotation
    iv. Specific methods of sample collection, frequency, analysis, and results used to test the nutrient content of the soil

v. A field-specific assessment of the potential for nitrogen and phosphorus transport from the field to surface or ground waters
vi. Quantification of all nitrogen and phosphorus sources
vii. Complete nutrient budget for nitrogen and phosphorus for the rotation or crop sequence
viii. Recommended and actual nitrogen and phosphorous application rates, timing, and method of application
ix. Expected frequency of land application
x. Description of equipment used for land application, calibration procedures and records.

f. Meet the technical standards for nutrient management, as described in Appendix C. Specifically, the NMP will address a field-specific assessment, expected crop yield, nutrient needs of the crop, and a nutrient budget.

VI. Other Information

On September 21, 2000, a U.S. District Judge issued an order stating that until all necessary total maximum daily loads (TMDLs) under Section 303(d) of the Clean Water Act are established for a particular water quality limited segment (WQLS), the State is not to issue any new or increased permits under the MPDES program. The order was issued in the lawsuit Friends of the Wild Swan v. U.S. EPA, et al. (CV 97-35-M-DWM), District of Montana and Missoula Division.

The DEQ finds that renewal of this permit does not conflict with Judge Molloy's Order (CV 97-35-M-DWM) because the receiving waters have never been identified as water quality limited segments.

VII. Information Source

40 CFR, Parts 122, 136, July 1, 2000.

CDM. Town of Sheridan Preliminary Engineering Report Wastewater System. May 2006.

DEQ. Circular WQB-7, Montana Numeric Water Quality Standards. February 2006.

DEQ. ARM (Administrative Rules of Montana) 17.30.601-670. Montana Surface Water Quality Standards. February 2006.

DEQ. ARM 17.30.701-717. Nondegradation of Water Quality. June 1996.

DEQ. ARM 17.30.1201-1209, 17.30.1301-1387. Montana Pollutant Discharge Elimination System (MPDES). March 2003.

DEQ. Department Circular DEQ-9, "Montana Technical Standards for Concentrated Animal Feeding Operations". February 2006.

DEQ. 2006 Montana Integrated Water Quality Report. 2006.

EPA. Combined Sewer Overflows: Guidance for Monitoring and Modeling. EPA 832-B-99-002. January 1999.

EPA. Technical Guidance Manual for Developing Total Maximum Daily Loads – Book II: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. EPA 823-B-95-007. September 1995.

EPA. Technical Support Document for Water Quality-Based Toxics Control (TSD), EPA/505/2-30-001. March 1991.

MCA (Montana Code Annotated), Title 75-5-101 *et seq*., "Montana Water Quality Act". 2003.

NRIS. Topographic Map Finder for Montana (USGS 7 ½ mininute quadrangle), Website for Montana Maps. Web address: http://nris.mt.gov/interactive.html. Accessed on: June 12, 2007.

Thomann, Robert V. and Mueller, John A. Principles of Surface Water Quality Modeling and Control. Harper-Collins Publishers. 1987

Prepared by: Rebecca Ridenour
Date: June 12, 2007

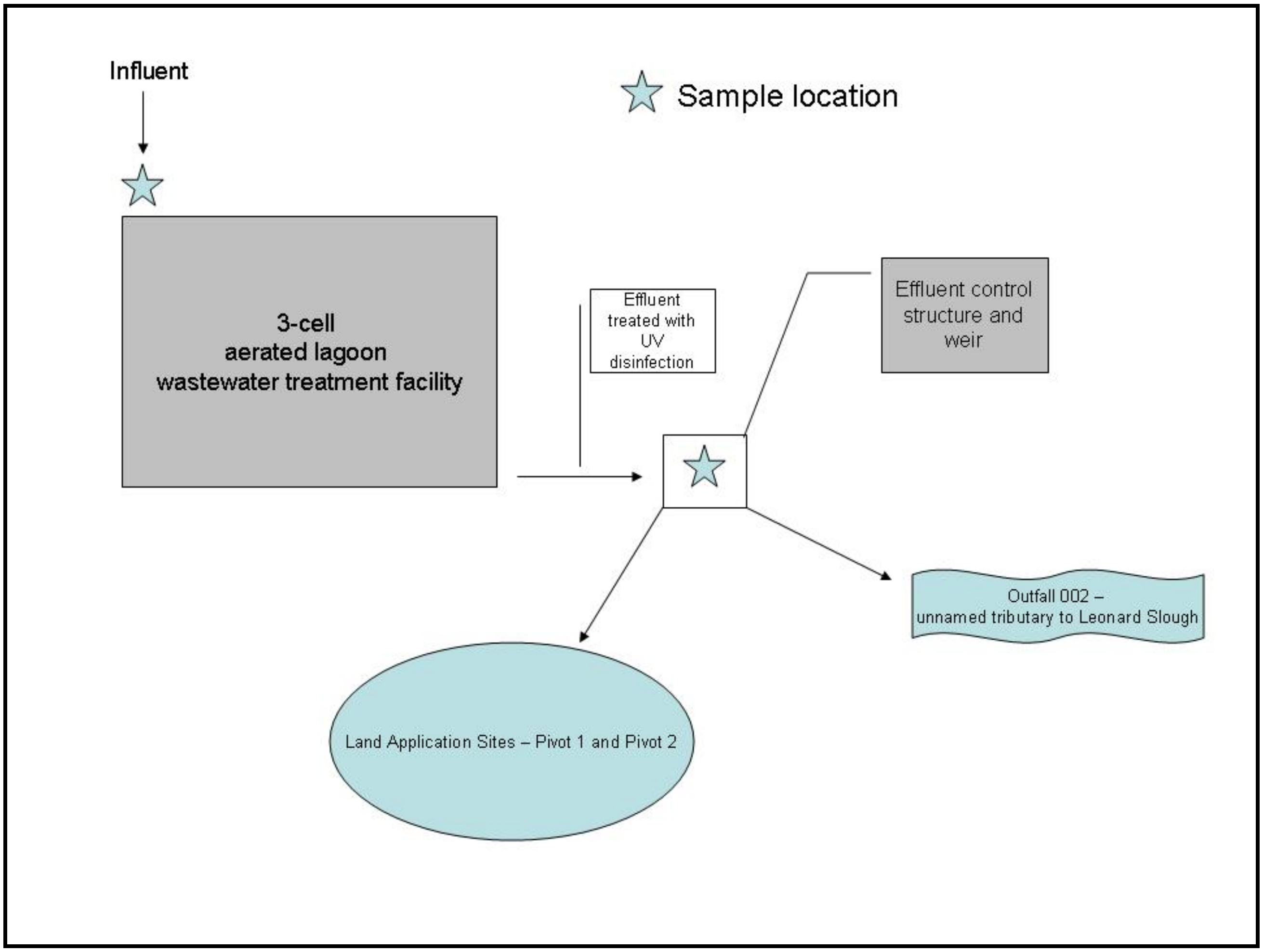

Figure 3: Proposed new 3-cell aerated lagoon facility schematic showing sample locations and discharge options.

APPENDIX A

Parameter:	Ammonia
Restriction:	October 1 through April 30
Facility:	Town of Sheridan
Permit Number:	MT0022098
Receiving Water:	Unnamed trib to Leonard Slough
Date:	3/28/2007

Condition		%	Chronic	Acute	Other
Acute Std, mg/L (Table 7)				0.36	
Chronic Std, mg/L (Table 7)			0.36		
Mixing Zone					
7Q10	cfs		3.1		
Chronic MZ	cfs	25	0.775		
Acute MZ	cfs	10		0.31	
Effluent Flow (design)	cfs		0.630	0.630	
Water Quality Std.	mg/L		0.36	0.36	
Background Conc. (Table 6)	mg/L		0.10	0.10	
Wasteload Allocation (from mass balance)					
WLAc	mg/L		0.68		
WLAa	mg/L			0.49	
Long-Term Average -Calc.					
Coeff. Variation (CV)	na				0.6
Percentile	%				95
LTAc, multiplier Table 5-1			0.64		
LTAa, multiplier Table 5-1				0.47	
LTAc	mg/L		0.44		
LTAa	mg/L			0.23	
LTA=min(LTAc, LTAa)	mg/L		0.23	0.23	
AML, multiplier Table 5-2			1.55		
MDL, multiplier Table 5-2				2.13	
			AML	MDL	
Final Effluent Limit	mg/L		0.4	0.5	

Comment: CV=0.6 when n<10. The 95th percentile & n=4 were used for multiplier determinations.

APPENDIX B

Streeter-Phelps equation (EPA, 1999): $D_c = D_o e^{-K_a t} + \frac{W}{Q}\left(\frac{K_d}{K_a - K_r}\right)[e^{-K_r t} - e^{-K_a t}]$

Equation Parameter	Definition (units)	Value used in equation and supporting assumptions
$\mathbf{D_c}$	DO deficit downstream of effluent (mg/L)	**2.5 mg/L**
$\mathbf{D_o}$	Initial DO deficit	Zero
W	Total pollutant loading rate (lbs/day)	**293 lbs/day** based on: • Nat'l secondary standard for 30-day average CBOD = 25 mg/L. • CBOD/UCBOD ratio = 1.6 based on secondary treatment • NH_3-N = 10 mg/L (assumed average effluent concentration) * 4.57 (oxygen utilized in NH_3 conversion to NO_3) • Design flow = 0.41 mgd = 0.6 cfs
Q	Total river flow (cfs)	**3.7 cfs** = Upstream flow (3.1 cfs) + effluent design flow (0.6 cfs)
$\mathbf{K_d}$	Biochemical oxygen demand (BOD) deoxygenation rate	**0.8/day** – based on Figure A-6, EPA 823-B-95-007, 1995, and depth of 0.5 feet
$\mathbf{K_a}$	Atmospheric re-aeration rate	**2.5/day –** based on Langbein & Durum "USGS equation" (EPA, 1995): $K_a = \frac{7.6U}{H^{1.33}}$, Where: U = average velocity (ft/sec), H = average depth (feet) Actual stream data: U = 0.48 ft/sec, H = 1.34 feet
$\mathbf{K_r}$	BOD loss rate	$\mathbf{K_r}$ **= 0.8/day** because: $K_r = K_d + K_s$, assume K_s(rate of settling) = zero
t	Time of passage from source to downstream location	Location where maximum DO deficit is projected to occur. **t = 0.7** days, based on: $t = \frac{1}{K_a - K_r}\ln\left(\frac{K_a}{K_r}\right)$

The receiving water DO saturation, c_s, in equilibrium with the atmosphere is dependent on water temperature, salinity (chlorinity), and pressure. The saturation is also dependent on the receiving water elevation above sea level. Salinity (S) is related to chlorinity as: S = 1.80655 * chlorinity (Thomann and Mueller, 1987). Freshwater salinity is typically less than 0.5 parts per thousand (ppt). Therefore, chlorinity is 0.3 or negligible.

For the unnamed tributary to Leonard Slough (Outfall 002), the water temperature was 2°C and DO was 11.3 mg/L on December 20, 2006. The elevation of the receiving water is approximately 4,760 feet above sea level (NRIS, 2007). At a zero chlorinity, c_s is 13.829 mg/L at sea level. An adjustment to the receiving water elevation is by the following equation: % c_s at sea level = 100-

0.0035 H, where H = elevation (Thomann and Mueller, 1987). The receiving water c_s is 11.478 mg/L or 83% of c_s at sea level (% c_s at elevation = 100-0.0035*4,760 feet = 0.83, or 83%).

The following table has temperature, c_s, and receiving water DO values with D_c subtracted from c_s.

Temperature (°C)	C_s (mg/L and corrected to 4,760' elevation above sea level)	Receiving water DO, mg/L (minus D_c = 2.7 mg/L)
0	12.1	9.4
5	10.6	7.9
10	9.4	6.6
15	8.4 **	5.7
20	7.5	4.8
Footnote: ** C_s value at 15°C is used for BOD_5 limit derivation.		

APPENDIX C

Following is the complete Section 6 directly copied from the Department Circular DEQ-9, "Montana Technical Standards for Concentrated Animal Feeding Operations" (February 2006). The complete document is available the Department website at: http://www.deq.mt.gov/wqinfo/MPDES/CAFO.asp. This document has the technical criteria required for a Nutrient Management plan that is required for the land application of treated wastewater.

Nutrient Management Plan (NMP) technical standards

The following technical standards for nutrient management are applicable to land application sites of Large Dairy Cow, Cattle, Swine, Poultry, and Veal Calf CAFOs. Application rates for manure, litter, and other process wastewater applied to land under the ownership and operational control of the CAFO **must** be determined according to the following procedure:

1. A field-specific assessment, as specified below, **must** be conducted to determine the appropriate basis for application rates (nitrogen or phosphorus based applications);
2. The expected crop type and yield for each field **must** be estimated, as specified below;
3. The appropriate nutrient needs for the crop **must** be determined, as specified below;
4. A nutrient budget **must** be conducted, as specified below, in order to determine the manure application rate. Representative manure and soil tests **must** be used in calculating the application rate.

Field-Specific Assessment

To determine the appropriate basis for application rates, the producer **shall** first conduct a field-specific assessment to determine the potential for phosphorus and nitrogen transport from the field to state waters. The results of this field-specific risk assessment **shall** be used to determine if manure, litter, and/or process wastewater should be land applied based on the nitrogen or phosphorus needs of the crop, or whether land application to the field(s) should be avoided.

In order to provide flexibility, the Department has established two different methods for conducting this field-specific assessment. The producer has the option of conducting the Phosphorus Index, as detailed in Attachment 2, or taking a representative soil sample and having it analyzed for phosphorus (Olsen P test).

If the Phosphorus Index (PI) is used to conduct a field-specific assessment, the calculated PI rating **must** be used to determine the appropriate application basis, as follows:

Table 8: Phosphorus Application based on PI

Phosphorus Index Risk Rating	Application Basis
Low	Nitrogen need
Medium	Nitrogen need
High	Phosphorus need up to crop removal
Very High	Phosphorus crop removal or no application

Source: NRCS Specification MT590, July 2002

If a representative soil sample is used to conduct a field-specific assessment, the Olsen P test results, in ppm, **must** be used to determine the appropriate application basis, as follows:

Table 9: Phosphorus Application from Soil Test Results

Olsen P Soil Test (ppm)	Application Basis
≤ 8.0	Nitrogen need
8.1-25.0	Nitrogen need
25.1-100.0	Phosphorus need
100.1-150.0	Phosphorus need up to crop removal
>150.0	No application

Source: NRCS Specification MT590, July 2002

Expected Crop Yield

Actual yield records from previous years **shall** be used to estimate the crop yields for the upcoming season, using the following equation:

Estimated Yield, bu/acre or t/a = 1.05 x Average Yield in bu/acre or t/a (based on past records)

Yield goals for cereals and safflower can be estimated using an alternative method as described in NRCS Code 590 (included in Attachment 4 of this circular).

Nutrient Needs of Crop

The Fertilizer Guidelines for Montana Crops published by Montana State University Extension Service Educational Bulletin 161 in January 2003 (included in Attachment 3 of this circular) **must** be used to determine crop nutrient needs based on the appropriate basis for application rates (nitrogen or phosphorus based applications), crop type, and estimated yield. For crops not listed in this bulletin, the Department may approve the use of site-specific information to determine fertilizer rates.

Nutrient Budget

Once the estimated nutrient needs of the crop, in lbs/acre, have been determined the producer **shall** conduct a nutrient budget. This nutrient budget accounts for all sources of nutrients available to the crop. These other sources include:

- Credits from previous legume crops. Legume plants fix atmospheric nitrogen and bring it into the soil. The amount of nitrogen added by legume production varies according to plant species and growing conditions. The following table 10 **must** be used to determine the appropriate legume crop credits for Montana:

Table 10. Legume Crop Credits

Legume	Nitrogen Fixation (lbs/acre)*
Alfalfa (after harvest)	40-80
Alfalfa (green manure)	80-90
Spring Pea	40-90
Winter Pea	70-100
Lentil	30-100
Chickpea	30-90
Fababean	50-125
Lupin	50-55
Hairy Vetch	90-100
Sweetclover (annual)	15-20
Sweetclover (biennial)	80-150
Red Clover	50-125
Black Medic	15-25
*The maximum N fixation in lbs/acre **must** be used unless appropriate justification is given showing lower N fixation is appropriate. In all cases, the N fixation used **must** be within the ranges specified above.	

Source: NRCS Specification MT590, July 2002

- Residuals from past manure applications. Nitrogen is a mobile nutrient that occurs in many forms. Not all nitrogen in land-applied manure is available to the crop during the year of application. Organic material decomposition is required before it is made available for plants. A percentage of last year's nitrogen and an even smaller percentage of the previous year's nitrogen will become plant-available during the current crop season. Therefore, mineralization rates as specified in Table 11 **must** be used to determine the amount of nitrogen available from previous manure application(s). Typically, organic phosphorus is considered 100% plant-available the year of application. Therefore, no residual amounts of phosphorus need to be calculated.

Table 11. Mineralization Rates

Type of Waste	1st Year after Application Fraction Available*	2nd Year After Application Fraction Available
Fresh poultry manure	0.90	0.02
Fresh swine manure	0.75	0.04
Fresh Cattle manure	0.70	0.04
Fresh sheep and horse manure	0.60	0.06
Liquid manure, covered tank	0.65	0.05
Liquid manure, storage pond	0.65	0.05
Solid manure, stack	0.60	0.06
Solid manure, open pit	0.55	0.05
Manure pack, roofed	0.50	0.05
Manure pack, open feedlot	0.45	0.05
Storage pond effluent	0.40	0.06
Oxidation ditch effluent	0.40	0.06
Aerobic lagoon effluent	0.40	0.06
Anaerobic lagoon effluent	0.30	0.06
* If irrigated, reduce 1st year mineralization by 0.05		

Source: NRCS Specification MT633, August 2001

- Nutrients supplied by commercial fertilizer. Animal manure does not have the same nutrient value as commercial fertilizer. Because animal manure contains relatively high concentrations of phosphorus, crops are not always supplied with enough nitrogen when manure is applied on a phosphorus basis. For that reason, farmers often supplement animal manure applications with commercial fertilizer to meet the crop's total nitrogen requirements. CAFOs **shall** include nutrient contribution from this other source in manure application rate calculations.

- Irrigation water. Irrigation water often contains some nitrogen in the form of nitrate nitrogen. Also, contaminated storm water runoff contains nutrients. CAFOs **shall** include nutrient contributions from this source in manure application rate calculations. A nutrient analysis of the irrigation water **must** be conducted to calculate the amount of nitrate nitrogen applied with irrigation water (ppm, mg/L).

In addition, because nitrogen losses occur through volatilization, the availability of nitrogen to crops is affected by the application method used (ie. broadcast, incorporated, etc.). Nitrogen availability **must** be adjusted to reflect the method of application as specified in Table 12.

TABLE 12. NITROGEN AVAILABILITY AND LOSS AS AFFECTED BY METHOD OF APPLICATION

Application Method	Nitrogen Availability and Loss as Affected by Method of Application
Injection (sweep)	0.90
Injection (knife)	0.95
Broadcast (incorporated within 12 hours)	0.7
Broadcast (incorporated after 12 hours, but before 4 days)	0.6
Broadcast (incorporated after 4 days)	0.5
Sprinkling	0.75

Source: NRCS Specification MT633, August 2001

The following table (Table 13) **must** be used to conduct a nutrient budget:

Table 13. Nutrient Budget Worksheet

Nutrient Budget	Nitrogen-based Application	Phosphorus-based Application
Crop Nutrient Needs, lbs/acre (from MSU EB161, January 2003)		
(-) Credits from previous legume crops, lbs/acre (from Table 10)		
(-) Residuals from past manure production, lbs/acre (lbs/acre applied in previous year(s) x fractions listed in Table 11)		
(-) Nutrients supplied by commercial fertilizer and Biosolids, lbs/acre		
(-) Nutrients supplied in irrigation water, ppm or mg/L (from nutrient analysis)		
= **Additional Nutrients Needed, lbs/acre**		
Total Nitrogen and Phosphorus in manure, lbs/ton or lbs/1,000 gal (from manure test)		
(x) Nutrient Availability factor (for Nitrogen based application see Table 12 above; for Phosphorus based application use 1.0)		
= **Available Nutrients in Manure, lbs/ton or lbs/1,000 gal**		
Additional Nutrients needed, lbs/acre (calculated above)		
(/) Available Nutrients in Manure, lbs/ton or lbs/1,000 gal (calculated above)		
= **Manure Application Rate, tons/acre or 1,000 gal/acre**		

<u>Multi-Year Phosphorus Application Rate</u>

In some situations, it may be necessary to use a multi-year phosphorus application rate. This approach consists of applying a single application of manure at a rate equal to the recommended phosphorus application rate or estimated phosphorus removal in harvested plant biomass for the crop rotation for multiple years in the crop sequence. These applications may provide the phosphorus needed for multiple years.

In this situation, CAFOs **may not** apply additional phosphorus to these fields until the amount applied in the single year had been removed through plant uptake and harvest. However, even under the multi-year application rate, CAFOs **may not** exceed the annual nitrogen recommendation of the year of application. In addition, the Phosphorus Index **must** be used to evaluate the potential for phosphorus runoff to surface waters. Fields with a Very High PI rating **may not** utilize a multi-year phosphorus application.

<u>Other Acceptable Methods</u>

The Natural Resources Conservation Service has developed standards for nutrient management and waste utilization. These methods, included in Attachments 4 and 5, may be used in lieu of the above-mentioned technical standards for nutrient management provided the following conditions are met:

- A field-specific assessment of the potential for nitrogen and phosphorus transport from the field to surface waters **must** be conducted;
- The form, source, amount, timing, and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and phosphorus movement to surface waters **must** be addressed;
- Appropriate flexibilities for the CAFO to implement multi-year phosphorus application on fields as described above **must** be included;
- Manure **must** be sampled a minimum of once annually for nitrogen and phosphorus content;
- Soil **must** be analyzed a minimum of once every five years for phosphorus content; and,
- The results of the manure and soil sampling analyses **must** be used in determining application rates of manure, litter, and other process wastewater.